RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: June 2001

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

	COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	55,551	86,448	59,672	67,480	67,631	69,753	71,788	73,920	Continuing	TBD
4506	Surveillance Technology	6,421	0	0	0	0	0	0	0	Continuing	TBD
4519	Communications Technology	11,992	22,313	14,368	15,513	14,640	15,975	16,444	16,940	Continuing	TBD
4594	Information Technology	13,861	32,367	22,606	22,998	23,516	23,820	24,530	25,272	Continuing	TBD
4600	Electromagnetic Technology	9,273	10,496	0	0	0	0	0	0	Continuing	TBD
4917	Collaborative Information Tech	0	0	5,200	5,741	5,182	5,321	5,441	5,572	Continuing	TBD
5581	Command and Control (C2) Technology	14,004	21,272	17,498	23,228	24,293	24,637	25,373	26,136	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0

Note: In FY 2001, the effort performed in Project 4506 moves into Project 4594. In FY 2002, portions of efforts accomplished in Project 4519, Project 4594, and Project 5581 move into Project 4917. In FY 2002, the effort accomplished in Project 4600 moves into PE 0602204F, Project 4916. This realignment aligns projects with the Air Force Research Laboratory organizational structure. FY 2003 - FY 2007 budget numbers do not reflect the DoD strategy review results.

(U) A. Mission Description

This program develops the technology base for Air Force Command, Control, and Communications (C3). Advances in C3 are required to increase warfighter readiness by providing the right information, at the right time, anywhere in the world. The program has four projects. The Communication Technology project develops assured, secure communications technology. The Information Technology project develops improved and automated capabilities to generate, process, fuse, exploit, interpret, and disseminate timely and accurate information. The Collaborative Information Technology project develops high payoff emerging technologies for the next generation of distributed, collaborative command and control systems. The Command and Control Technology project investigates and develops planning, assessment, and knowledge base technologies to allow the warfighter to plan, assess, execute, monitor, and re-plan on the compressed time scales required for tomorrow's conflicts. Note: In FY 2001, Congress added $8.5 million for simulation-based acquisition.

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(U) B. Budget Activity Justification

This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

(U) C. Program Change Summary ($ in Thousands)

		FY 2000	FY 2001	FY 2002	Total Cost
(U)	Previous President's Budget (FY 2001 PBR)	52,085	78,749	63,166	
(U)	Appropriated Value	52,148	87,249		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions	-18			
	b. Small Business Innovative Research	-1,064			
	c. Omnibus or Other Above Threshold Reprogram				
	d. Below Threshold Reprogram	4,689			
	e. Rescissions	-204	-801		
(U)	Adjustments to Budget Years Since FY 2001 PBR			-3,494	
(U)	Current Budget Submit/FY 2002 PBR	55,551	86,448	59,672	TBD

(U) Significant Program Changes:

In FY 2002, a decrease in this program is due to the realignment of electromagnetic efforts. Electromagnetic efforts move from this PE into PE 0602204F as part of the Air Force's Science and Technology PE realignment.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

DATE: June 2001

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

PROJECT: 4506

COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
4506 Surveillance Technology	6,421	0	0	0	0	0	0	0	Continuing	TBD

Note: In FY 2001, the effort accomplished in Project 4506, moves into Project 4594.

(U) A. Mission Description

The Air Force requires advanced surveillance and fusion technologies to improve the performance and reduce the cost of Air Force surveillance systems. Major Applied Research areas of interest include: low-observable surveillance; passive surveillance; information fusion; and advanced processing technologies. Technologies being developed include: spatial coordinate and time processing techniques; sensor and data fusion; and advanced signal processors.

(U) FY 2000 ($ in Thousands)

(U) $2,024 Demonstrated and assessed operational algorithms for processing massive global databases, to produce improved real-time multispectral and multisensor data fusion, delivering an enhanced air and space situational picture.

(U) $2,016 Developed multisensor fusion algorithms in a fully distributed environment. Completed development and demonstration of fusion quality measures validating enhanced performance.

(U) $2,381 Developed embedded, affordable, scalable, teraflop processing technologies for real-time information fusion and exploitation. Completed design and implementation technologies for fully programmable, scaleable, affordable teraflop processors for real-time fusion and processing.

(U) $6,421 Total

(U) FY 2001 ($ in Thousands)

(U) $0 Effort moves to Project 4594.

(U) $0 Total

(U) FY 2002 ($ in Thousands)

(U) $0 No Activity

(U) $0 Total

(U) B. Project Change Summary

Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE: June 2001

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
02 - Applied Research	0602702F Command Control and Communications	4506

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:

(U) PE 0603789F, C3I Advanced Development.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

DATE: June 2001

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

PROJECT: 4519

COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
4519 Communications Technology	11,992	22,313	14,368	15,513	14,640	15,975	16,444	16,940	Continuing	TBD

Note: In FY 2002, a portion of the effort accomplished in Project 4519 moves into Project 4917.

(U) A. Mission Description

The Air Force requires technologies that enable assured, worldwide communications for an agile Expeditionary Aerospace Force (EAF). These communication technologies will provide en-route and deployed reachback communications for distributed collaborative command and control (C2). A rapidly deployed EAF requires assured connectivity with reliable, responsive, affordable information exchange via all available communications media. This project provides the technologies for: multi-level, secure, seamless networks; advanced communications processors; anti-jam and low probability of intercept techniques; lightweight, phased array antennas; and modular, programmable, low-cost radios. It includes technologies for advanced processors and devices, advanced network protocols and services, intelligent communications management and control, advanced communications algorithms, and enabling communication signal processing techniques.

(U) FY 2000 ($ in Thousands)

(U) $4,500 Developed assured and survivable information and networking technologies enabling the capability for worldwide command, control and communication operations for EAF. Developed assurance of services and universal transaction services technologies for improved security, survivability, and timeliness in a global, seamless, distributed communications network employing wireless and wired links.

(U) $5,053 Developed critical communications and signal processing technologies to provide adaptive, covert, anti-jam, and assured global battlespace connectivity to aerospace forces and greatly reduce equipment footprint. Continued millimeter component development and the Smart Network Radio program.

(U) $2,439 Developed Defensive Information Warfare tools and technologies to ensure information protection and security of sensitive and encrypted Air Force communication and information systems. Developed net visualization tools and attack indicators. Developed automated capability for computer forensics analysis.

(U) $11,992 Total

(U) FY 2001 ($ in Thousands)

(U) $7,400 Develop assured and survivable information and networking technologies enabling the capability for worldwide command, control and communication operations for EAF. Develop information systems and networking technologies for globally distributed information systems. Continue to develop technologies to provide managed, seamless global information exchange for the Air Force, in a joint/coalition environment. Develop technologies to improve quality of service, robustness, security, and survivability of mission-critical information.

(U) $7,484 Develop critical assured communications and signal processing technologies to provide adaptive, covert, anti-jam, and assured global battlespace

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE June 2001
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602702F Command Control and Communications	PROJECT: 4519

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

connectivity to aerospace forces and greatly reduce equipment footprint. Continue to develop and apply critical multiband and wideband wireless communications technologies for assured communications in Joint and Coalition environments. (In FY 2002, a portion of this effort moves into Project 4917.)

(U) $7,429 Develop Defensive Information Warfare tools and technologies to ensure information protection and security of sensitive and encrypted Air Force communication and information systems. Continue to develop net visualization tools and attack indicators. Continue to develop automated capability for computer forensics analysis. Develop preemptive indicators, damage assessment, and recovery techniques.

(U) $22,313 Total

(U) FY 2002 ($ in Thousands)

(U) $5,600 Develop assured and survivable information and networking technologies enabling the capability for worldwide command, control and communication operations for Expeditionary Aerospace Forces. Continue to develop technologies to improve quality of service for globally distributed information systems. Continue to develop assured networking and information systems technologies to improve survivability to critical infrastructure attacks. Complete development of technologies for assured wireless networking algorithms.

(U) $3,539 Develop critical assured communications and signal processing technologies to provide adaptive, covert, anti-jam, and assured global battlespace connectivity to aerospace forces and greatly reduce equipment footprint. Investigate and develop techniques to improve information assurance capabilities for mobile wireless networks to preclude information attacks aimed at denial of service and quality of service degradation. Continue to develop mobile communication technologies for wide-band data and video services to beyond-line-of-sight airborne command and control, and sensor platforms.

(U) $5,229 Develop Defensive Information Warfare tools and technologies to ensure information protection and security of sensitive and encrypted Air Force communication and information systems. Continue to develop automated capability for damage assessment and recovery of information systems. Develop computer and network forensics tools. Develop data mining tools for coordinated information warfare attack assessment. Investigate techniques to perform analysis on detection and eradication of malicious software.

(U) $14,368 Total

(U) B. Project Change Summary

Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE: June 2001

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
02 - Applied Research	0602702F Command Control and Communications	4519

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:

(U) PE 0603789F, C3I Advanced Development.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

DATE: June 2001

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

PROJECT: 4594

COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
4594 Information Technology	13,861	32,367	22,606	22,998	23,516	23,820	24,530	25,272	Continuing	TBD

Note: In FY 2002, a portion of the effort accomplished in Project 4594 moves into Project 4917.

(U) A. Mission Description

The Air Force requires technologies that improve and automate their capability to generate, process, manage, fuse, exploit, interpret, and disseminate timely and accurate information. This project improves global awareness at all levels, enabling warfighters to understand relevant military situations on a consistent basis, with the timeliness and precision needed to accomplish their missions. Global awareness is achieved by exploiting information provided by the Air Force and other government agencies. The information is fused to support the dynamic planning and execution cycle via the global information enterprise. Knowledge, information, and data are archived in the global information base for continued use and historical analysis. The information technologies required to achieve this capability are developed under this project in an affordable manner, and include appropriate access mechanisms for our coalition partners. Note: In FY 2001, Congress added $8.5 million for simulation-based acquisition.

(U) FY 2000 ($ in Thousands)

(U) $4,235 Developed information exploitation technologies for imagery and electronic signals to increase global awareness. Automated multisensor and multimedia technologies to automatically detect and track targets using radiated signals across the entire spectrum for precision location and identification.

(U) $4,783 Developed and evaluated innovative multisensor collaborative fusion technologies in a fully distributed aerospace environment. Developed innovative multisensor collaboration system to fuse events in time and space, to locate and identify objects, and to project future behavior for spaceborne systems in a fully distributed fusion environment.

(U) $4,843 Developed global information base technologies for global, theater, and local situation awareness providing timely and accurate input to dynamic planning and execution operations. Developed information extraction technology to retrieve data from text and automatically put into structured formats enabling the warfighter to process large volumes of text faster and more effectively.

(U) $13,861 Total

(U) FY 2001 ($ in Thousands)

(U) $4,800 Develop information exploitation technologies for imagery and electronic signals to increase global awareness. Continue to develop multisensor, multimedia analytical techniques to automatically detect and track the presence and location of objects (target, non-targets both civilian and military) and extract changes in the information. Investigate advanced information dissemination techniques for seamless integration into the global information base via the global grid.

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BUDGET ACTIVITY 02 - Applied Research	PE NUMBER AND TITLE 0602702F Command Control and Communications
PROJECT 4594	

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

(U)	$7,569	Develop and evaluate innovative multisensor collaborative fusion technologies in a fully distributed aerospace environment. Develop and evaluate collaborative multisensor technologies for near-real-time cueing and retasking of sensors for dynamic fusion of information, addressing surface, airborne, and spaceborne systems in a fully distributed environment.
(U)	$5,081	Develop global information base technologies to achieve situational awareness at all command levels for the dynamic planning and execution process. Develop and investigate technology concepts that employ multiple levels of abstraction to rapidly extract information from globally distributed databases, to provide timely and accurate information to dynamic planning and execution operations. Continue to develop information extraction technology to retrieve data from text and automatically insert into structured formats, enabling the warfighter to process large volumes of text faster and more effectively.
(U)	$2,674	Develop embedded, affordable, scalable, teraflop processing technologies for real-time information fusion and exploitation. Develop and evaluate technology for real-time information fusion and exploitation for Expeditionary Aerospace Force situational awareness that is 100 times more affordable than current embedded and radiation hardenable high performance processing systems.
(U)	$6,083	Develop information technologies that significantly reduce the develop cost of complex electronic systems. Complete the development of a requirements modeling representation concisely capturing the engineering requirements for computer-aided simulation, verification, and analysis. Complete the research for making digital hardware models more reusable. Develop an interface between digital hardware models and battlespace models, enabling more of a system to be verified by simulation. (In FY 2002, this effort moves to Project 4917.)
(U)	$6,160	Develop modeling and simulation technologies to support next generation distributed collaborative environments. Evaluate, exploit, and develop techniques to expand the capability while reducing the complexity of existing high-resolution models and simulations for the National Air and Space Warfare Model. Develop simulation techniques to provide accurate, real-time decision support for the next generation distributed collaborative environments.
(U)	$32,367	Total

(U) FY 2002 ($ in Thousands)

(U)	$5,900	Develop information exploitation technologies for imagery and electronic signals to increase global awareness. Develop advanced multi-sensor open systems techniques and tools for production of imagery (including hyperspectral), electronic signals, and speech intelligence products to achieve situation awareness. Develop advanced information dissemination techniques for seamless integration into global information databases.
(U)	$6,000	Develop and evaluate innovative multi-sensor collaborative fusion technologies in a fully distributed aerospace environment. Develop techniques to quantitatively evaluate fusion algorithms. Develop and evaluate fusion technologies for multi-platform cross-cueing of sensors for the location and identification of military targets, addressing surface, airborne, and spaceborne systems in a fully distributed environment.

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PROJECT 4594	

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

(U)	$6,480	Develop global information base technologies to achieve situational awareness at all command levels for the dynamic planning and execution process. Investigate information extraction techniques to automatically populate very large knowledge base systems. Develop approaches for synthesizing a common data representation from multiple sources for improved situational awareness. Investigate methods of content-based retrieval techniques for improved sensor data exploitation and faster data base access.
(U)	$2,688	Develop affordable, scalable, teraflop processing technologies for real-time information fusion and exploitation. Develop processor-in-memory, content-addressable architecture for rapid extraction of information from globally distributed knowledge bases. Develop architectures to support real-time requirements for dominant battlespace awareness.
(U)	$1,538	Develop modeling and simulation technologies to support next generation planning, execution, and assessment environments. Evaluate, exploit, and develop model abstraction and multi-resolution modeling techniques to reduce the complexity of existing high-resolution models and simulations, and to support the National Air and Space Model and the joint battlespace infosphere.
(U)	$22,606	Total

(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:

(U) PE 0603789F, C3I Advanced Development.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

DATE: June 2001

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

PROJECT: 4600

COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
4600 Electromagnetic Technology	9,273	10,496	0	0	0	0	0	0	Continuing	TBD

Note: In FY 2002, the effort accomplished in this project moves into PE 0602204F, Project 4916.

(U) A. Mission Description

This project conducts research in electromagnetics and photonics technologies for application to Intelligence, Surveillance, and Reconnaissance (ISR) Systems. Future surveillance, communications, and imagery/information processing systems will require improved technology for the generation, control, processing, and radiation of electromagnetic and optical energy to reduce system cost, improve system sensitivity, and increase processing rates. Promising technologies for improving ISR systems are electromagnetic propagation and scattering (from targets and clutter) and antennas. This project develops technology and control techniques for large phased array antennas, infrared focal plane array technology, and characterizes phenomena for low-observable surveillance.

(U) FY 2000 ($ in Thousands)

(U) $2,760 Designed and developed electromagnetic technologies for advanced surveillance and reconnaissance systems applications. Developed and evaluated algorithms for a digital beam-formed multibeam antenna.

(U) $2,760 Designed and developed antenna concepts for aerospace surveillance and reconnaissance applications. Developed and evaluated advanced concepts for large, lightweight arrays. Developed and evaluated a three-dimensional optically excited antenna array.

(U) $3,753 Designed and developed electro-optical technology to enable passive or active targeting of difficult targets. Investigated ways of mitigating atmospheric phenomenology effects on extended range aerospace sensors. Developed turbulence compensation techniques for precision targeting, target signatures, and phenomenology models, and selected multifunction sensor target characteristics. Designed and developed infrared focal plane array technology.

(U) $9,273 Total

(U) FY 2001 ($ in Thousands)

(U) $3,396 Design and develop electromagnetic technologies for advanced surveillance and reconnaissance systems applications. Continue to develop and evaluate algorithms for a digital beam-formed multibeam antenna.

(U) $3,176 Design and develop antenna concepts for aerospace surveillance and reconnaissance applications. Continue to develop and evaluate advanced concepts for large, lightweight arrays. Continue to develop and evaluate a three-dimensional optically excited antenna array.

(U) $3,924 Design and develop electro-optical technology to enable passive or active targeting of difficult targets. Investigate ways of mitigating atmospheric phenomenology effects on extended range aerospace sensors. Continue to develop turbulence compensation techniques for precision targeting, target signatures, and phenomenology models, and selected multifunction sensor target characteristics. Continue to design

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PROJECT: 4600	

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

and develop infrared focal plane array technology.

(U) $10,496 Total

(U) FY 2002 ($ in Thousands)

(U) $0 In FY 2002, the effort moves into PE 0602204F, Project 4916.

(U) $0 Total

(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:

(U) PE 0602204F, Aerospace Sensors.

(U) PE 0603203F, Advanced Aerospace Sensors.

(U) PE 0603789F, C3I Advanced Development.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

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BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

PROJECT: 4917

COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
4917 Collaborative Information Tech	0	0	5,200	5,741	5,182	5,321	5,441	5,572	Continuing	TBD

Note: Prior to FY 2001, the effort in this project was previously accomplished in PE 0602204F, Projects 6096, 2003, and 7622. In FY 2001, the effort in this project was accomplished in Projects 4519, 4594, and 5581 in this PE.

(U) A. Mission Description

To implement the Expeditionary Aerospace Force concept, the Air Force requires a distributed, collaborative command and control (C2) system, allowing the majority of the C2 center to remain in CONUS, while only a small command element is deployed forward. This project accomplishes the initial exploration of high payoff emerging technologies for the next generation of distributed collaborative C2 systems. This program develops technologies for platform connectivity, collaboration and embedded information systems. Platform connectivity technologies focus on advanced modulation waveforms for bandwidth efficiency, assured aerospace platform connectivity for C2, and conceptual design approaches for seamless integration of aerospace weapon systems into the information grid. Collaboration technologies advance collaboration science, virtual environments, and predictive simulation tools to facilitate the development and fielding of next generation operational collaborative enterprises. Embedded information systems technologies explore high payoff technologies for the next generation of distributed information integration architectures, which will provide cross disciplinary products/capability to a decision maker when, where, and how it is needed. It also provides embedded information system technologies for affordable and adaptable design and development of complex C2 systems, facilitated by an open system architecture approach.

(U) FY 2000 ($ in Thousands)

(U) $0 The effort was accomplished in PE 0602204F, Projects 6096, 2003, and 7622.

(U) $0 Total

(U) FY 2001 ($ in Thousands)

(U) $0 The effort was accomplished in Projects 4519, 4594, and 5581 in this PE.

(U) $0 Total

(U) FY 2002 ($ in Thousands)

(U) $1,258 Develop critical information transmission technologies to permit the seamless integration of aerospace weapon systems command and control, intelligence, surveillance, and reconnissance data/information. Continue to develop assured, secure communications technology, leveraging the commercial infrastructure, for positive command and control of aerospace assets in civilian airspace. Continue to develop secure, wide-band wireless information transfer technology for assured communications by multiple weapon systems. (Prior to FY 2002, this effort was accomplished in Project 4519.)

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(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

(U)	$2,250	Develop advanced information technologies for collaborative decision support, knowledge management, and rapid adaptation/re-allocation of assets in response to the continuing changing threat environment. Develop technologies to support distributed decision making and collaborative planning for Expeditionary Aerospace Forces in a battlespace information environment. Develop technology to support a sensor-to-shooter scenario stressing the time-critical-target (TCT) requirement, resulting in denying the enemy the sanctuary of time. (Prior to FY 2002, this effort was accomplished in Projects 5581 and 4594.)
(U)	$1,692	Develop processes, methods, and techniques to provide assured performance, integrity, and security of real-time embedded information systems. Develop dynamically reconfigurable aerospace systems using adaptive computing techniques. Continue to develop concepts, designs, and models for the next generation command and control global information systems, which will allow affordable design and development of highly complex aerospace systems, and autonomous unmanned airborne/spaceborne platforms for deployment against time-critical targets. (Prior to FY 2002, this effort was accomplished in Project 5881.)
(U)	$5,200	Total

(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:

(U) PE 0603789F, C3I Advanced Development.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

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BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

PROJECT: 5581

COST ($ in Thousands)		FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
5581	Command and Control (C2) Technology	14,004	21,272	17,498	23,228	24,293	24,637	25,373	26,136	Continuing	TBD

Note: In FY 2002, a portion of the effort accomplished in Project 5581 moves into Project 4917.

(U) A. Mission Description

The Air Force requires Command and Control (C2) technologies which provide the next generation of weapon systems with improved processing and presentation of information for real-time, distributed battle management. Technologies being developed in this project will increase capability and quality, while reducing the cost of C2 systems and infrastructure. Technology development in this project focuses on planning and assessing techniques, knowledge bases, and distributed information systems. Advances in planning and assessment technologies will vastly improve the military decision making process within C2 systems. Advances in development of very large comprehensive knowledge bases to rapidly formulate and create new knowledge are needed by the Expeditionary Aerospace Force. Advances in distributed intelligent information systems will allow automatic rapid reconfiguration to varying crisis levels required by the Expeditionary Aerospace Force.

(U) FY 2000 ($ in Thousands)

(U) $6,616 Developed the next generation of planning and assessment technologies and tools enabling aerospace commanders to determine and create the desired operational effects at the right place at the right time. Developed intelligent information technologies including planning technology for coalition C2. Developed high performance knowledge-based technology for coordination and cooperative use of aerospace C2 resources.

(U) $2,078 Investigated and developed technologies for the rapid development and application of next generation knowledge-bases for C2 aerospace systems. Completed development of architecture-centered technology and modeling and analysis of evolvable software for increased capability, quality, and reliability of software-intensive systems. Developed techniques for knowledge-base theory slicing, merging, and conflict resolution.

(U) $5,310 Investigated, analyzed, and developed intelligent information management and user interface systems that tailor visualization strategies, information, access, and assurance mechanisms based on C2 application parameters.

(U) $14,004 Total

(U) FY 2001 ($ in Thousands)

(U) $6,158 Develop the next generation of planning and assessment technologies and tools enabling aerospace commanders to determine and create the desired operational effects at the right place at the right time. Develop technologies to dynamically assess the battlespace, determine measures to create the desired effects, and provide near-real-time command of forces to execute those measures. Develop technologies to provide alternative courses of action and feasibility assessment in uncertain environments.

(U) $1,963 Investigate and develop technologies for the rapid development and application of next generation knowledge-bases for aerospace C2 systems. Develop tools and techniques needed by an Expeditionary Aerospace Force for building very large comprehensive knowledge bases by rapidly

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE June 2001	
BUDGET ACTIVITY 02 - Applied Research	PE NUMBER AND TITLE 0602702F Command Control and Communications	PROJECT 5581

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

formulating and creating new knowledge, along with capabilities to re-use, augment, and repair existing knowledge-bases. Continue the development of techniques for knowledge-base theory slicing and merging, conflict resolution, and context management. Investigate new techniques to allow users to enter, validate, and manipulate knowledge using natural language, sketching, and templating approaches.

(U) $6,172 Investigate, analyze, and develop technologies for automatic rapid reconfiguration of distributed intelligent information systems to varying crisis levels faced by Expeditionary Aerospace Forces. Develop and evaluate advanced display and human-computer interface technologies for current and next generation command and control (C2) systems.

(U) $1,979 Develop tools and techniques to promote assured performance and affordability of complex air and space platforms. Continue to develop new techniques for rapidly incorporating new functions into scaleable, open architecture systems. Develop dynamically reconfigurable aerospace systems using field programmable gate arrays. Develop concepts and preliminary designs for the next generation global C2 information systems which will allow the seamless insertion of highly autonomous unmanned airborne and spaceborne platforms for deployment against time-critical targets. (In FY 2002, this effort moves to Project 4917.)

(U) $5,000 Develop the technologies, tools, and techniques required to ensure protection of critical command, control, and communications (C3) infrastructure. Develop the technologies which will allow a robust implementation of an overarching, integrated capability for protection of the global C3 infrastructure. Develop protection techniques with emphasis on integrity of information and availability of networks required for distributed, collaborative C2 systems.

(U) $21,272 Total

(U) FY 2002 ($ in Thousands)

(U) $5,399 Develop the next generation of planning and assessment technologies and tools enabling aerospace commanders to determine and create the desired operational effects at the right place at the right time. Continue to develop technologies to dynamically assess the battlespace, determine measures to create the desired effects, and provide near-real-time command of forces to execute those measures. Develop tools to visualize the probability of success of qualitatively different courses of action. Continue to develop technologies to provide alternative courses of action and feasibility assessment in uncertain environments. Investigate intelligent agent technologies capable of supporting C2 systems for various missions, from humanitarian relief to major theater warfare. Develop techniques to enable the rapid insertion of new forces and their C2 information management systems into a battlespace infosphere.

(U) $4,500 Investigate and develop technologies for the rapid development and application of next generation knowledge bases for aerospace C2 systems. Develop tools that allow users to enter, validate, and manipulate knowledge using natural language, sketching, and templating approaches. Develop knowledge representation techniques to enable the structured common representation (SCR) required for a battlespace infosphere.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE: June 2001
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602702F Command Control and Communications	PROJECT: 5581

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

Develop capabilities that learn to extract, correlate, and classify link patterns. Investigate enhanced reasoning techniques and algorithms for more complex inferencing and performance.

(U) $7,599 Investigate, analyze, and develop technologies for automatic rapid reconfiguration of distributed intelligent information systems to varying crisis levels faced by Expeditionary Aerospace Forces. Develop dynamic and adaptable interface technologies that allow commanders to create a mission-tailored view of the configuration and status of the currently executing Air Operations Center (AOC) command and control (C2) process. Develop advanced interactive displays suitable for deployment with C2 applications and command centers. Develop techniques and applications for information visualization for use in conjunction with multiple, heterogeneous data sets. Develop techniques for integrating legacy client-server C2 systems into the next generation of agile, web-enabled information management environments. Investigate approaches to enable C2 systems to smoothly scale to over 1,000 clients exchanging information using a publish-subscribe paradigm as required for a battlespace infosphere.

(U) $17,498 Total

(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:
(U) PE 060361F, C3 Applications.
(U) PE 0303401F, Communications-Computer Systems (C-CS) Security RDT&E.
(U) PE 0603789F, C3I Advanced Development.
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.